

What is claimed is:

subA'

1. A vertical heat exchanger comprising:  
a pair of a first fluid passing ports for flowing  
5 through a tube;  
a pair of a second fluid passing ports for flowing  
through a shell;  
a vent <sup>206</sup> pipe at least part of one end of which being made  
of an upper tube sheet <sup>208, 212</sup> part and the other end of which  
10 connected outside the heat exchanger to an immediately  
adjacent second fluid passing port passing the same fluid as  
the vent; and / or <sup>201</sup>  
a drain <sup>100</sup> pipe at least part of one end of which being  
made of a lower tube sheet part and the other end of which  
15 connected outside the heat exchanger to an immediately  
adjacent second fluid passing port passing the same fluid as  
the drain.
2. A heat exchanger according to claim 1, wherein a  
20 diameter (D) of the shell of the heat exchanger, a diameter  
(d) of the vent pipe, and a number (N) of vent pipes satisfy  
the formula,  $D/(d \times N) = 10 - 60$ .
3. A heat exchanger according to claim 2, wherein the  
25 diameter (D) of the shell of the heat exchanger, the diameter  
(d) of the vent pipe, and the number (N) of vent pipes  
satisfy the formula,  $D/(d \times N) = 10 - 40$ .
4. A heat exchanger according to claim 1, wherein a  
30 position of the outlet of a pipeline combined of the vent  
pipe with the second passing port is higher than that of the  
upper tube sheet of the heat exchanger.

5. A heat exchanger according to claim 1, wherein the heat exchanger is a member selected from the group consisting of a shell-and-tube heat exchanger and a spiral heat exchanger, wherein the upper tube sheet corresponds to an upper cover in the case of a spiral heat exchanger and the lower tube sheet corresponds to a lower cover in the case of the spiral heat exchanger.

10 6. A vertical heat exchanger comprising:

a pair of a first fluid passing ports for flowing through a tube;

a pair of a second fluid passing ports for flowing through a shell;

15 a vent pipe fixed on the shell of the heat exchanger and formed by having one end of a bent pipe disposed beneath an upper tube sheet and the other end thereof connected outside the heat exchanger to an immediately adjacent second fluid passing port passing the same fluid as the vent; and/or

20 a drain pipe fixed on the shell of the heat exchanger and formed by one end of a bent pipe disposed above a lower tube sheet and the other end thereof connected outside the heat exchanger to an immediately adjacent second fluid passing port passing the same fluid as the drain.

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7. A heat exchanger according to claim 6, wherein a position of the outlet of a pipeline combined of the bent pipe with the second passing port is higher than that of the upper tube sheet of the heat exchanger.

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8. A heat exchanger according to claim 6, wherein the heat exchanger is a member selected from the group consisting

of a shell-and-tube heat exchanger and a spiral heat exchanger, wherein the upper tube sheet corresponds to an upper cover in the case of a spiral heat exchanger and the lower tube sheet corresponds to a lower cover in the case of  
5 the spiral heat exchanger.

Sub A<sup>2</sup> 9. A method for introducing or discharging part or (the whole) of the second fluid through a drain pipe and/or a vent pipe set forth in claim 1.

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10. A method according to claim 9, wherein one of the first and second fluids is an easy polymerizable substance.

11. A method according to claim 10, wherein the other  
15 fluid is water.

Sub A<sup>3</sup> 12. A method according to claim 10, wherein (the polymerizable material) is at least one member selected from the group consisting of acrylic acid, methacrylic acid, an  
20 acrylic ester, a methacrylic ester, an aqueous acrylic acid solution and an aqueous methacrylic acid solution.

13. A method for introducing or discharging part or the whole of the second fluid through a drain pipe and/or a vent  
25 pipe set forth in claim 6.

14. A method according to claim 13, wherein one the first and second fluids is an easy polymerizable substance.

30 15. A method according to claim 14, wherein the other fluid is water.

